

Probe Radio Science in the Next Generation Deep Space Network

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The end-to-end evolution of NASA's Deep Space Network (DSN) is driven by the need to significantly improve performance for spacecraft communications and navigation. The next generation network is likely to have advanced capabilities for Ka-band links augmenting X-band, increased effective receiving area and radiated power, and other features affecting the quality of radio-metric observables. The DSN is a world-class instrument for Radio Science research and has contributed to numerous scientific discoveries. The typical limitations to the Radio Science experiments are frequency stability, amplitude stability, signal-to-noise ratio, spacecraft and ground pointing stability, spacecraft non-gravitational forces, ground mechanical and electronic noises, intervening media, and navigation accuracy in predicting & reconstructing trajectory. In this paper, we discuss how the next generation Deep Space Network will impact the limitations to Radio Science experiments, most positively. A study of likely configurations of the next generation DSN and the expected performance of Doppler and range parameters relevant to Radio Science will be presented. We also discuss how future probe mission can benefit from the improvements to conduct experiments in atmospheric science as well as gravitation with improved received signal-to-noise ratio and improved interplanetary plasma and ionospheric and tropospheric calibrations.